

## **Teaching children to cross-country ski**

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### **Snow, wax, and skis**

Snow is composed of crystals, and the shape of the crystals changes with age and temperature. The physics of what makes a ski glide are not well understood, but it is generally thought that a ski moving on snow melts some of the crystals so that the ski glides on microdroplets of water. As the temperature drops, it becomes increasingly difficult to melt the snow, therefore as the temperature drops you get less glide. It has been reported (but may be an exaggeration) that at -25C, snow has the same coefficient of friction as sand. Regardless, at temperatures below minus twenty, skis really don't glide very well.

As the snow gets warmer, glide improves. Glide is optimum when temperatures are between -5C and 0. When the air temperature is greater than 0, skis often become slower because of suction.

How does grip wax work? The snow crystals penetrate the wax, providing grip when you push down on the ski. As you move forward, the wax should release, allowing the ski to glide. If you have selected a wax that is too sticky (that is, too soft for the conditions) the snow won't release and you get a build up of ice in the grip zone. If you apply a wax that is not sticky enough (too hard for the conditions) the snow crystals can't penetrate the wax and you don't get any grip.

When the snow is very cold, grip waxing is relatively easy. As the snow warms up, the skis glide better but it becomes harder to make the skis grip, consequently you need to use stickier grip wax. When snow melts and refreezes, you are no longer dealing with snow: now you have ice. To get grip on ice you need extremely sticky stuff called klisters. Note that snow transforms as it gets older: it loses its crystalline structure, so you need to go with stickier wax to get grip.

### **Ski selection**

The flex (stiffness) of a ski is the most important facet of ski selection. It should take 60-80% of the skier's weight to flatten the ski. The reason for this is that when the skier has his or her weight evenly distributed between the two skis, as in double poling or going downhill, only 50% of the skier's weight is on each ski, allowing the wax pocket to ride above the snow thereby reducing drag and improving glide. The same thing happens

during the pole assisted glide phase: when the skier is gliding on one ski, all of the weight is on that ski. When the pole is planted, the weight on the ski is reduced and the ski glides better.

The length of the ski is not nearly as important as its stiffness. As a rough indicator, the skis should be longer than the student is tall, but should not be longer than the student's height plus approximately twenty centimetres. Shorter skis are much easier for beginners to use.

There are a number of ski terms that you should know:

- the *base* is the bottom of the ski. Most bases nowadays are made from a high molecular weight plastic called P-tex. P-tex is very hard but also very porous. The pores allow wax to penetrate the base and provide improved grip or glide.

- the top of the ski is called the *deck*. The sides are called the *sidewalls*.

- the ski boot is held to the ski with a *binding*.

- the part of the ski from the back of the binding to a point approximately 30 centimetres in front of the binding is called the *grip zone*.

- the part of the ski behind the binding is called the *tail*.

- the part of the ski in front of the grip zone is called the *tip*.

- flex* or *stiffness* is an indication of how much pressure has to be exerted to flatten a ski. One of the best ways to test a ski's stiffness is the paper test (see below).

- camber* is the shape of the ski, when viewed from the side. Camber is often used to describe stiffness, but this is incorrect. It comes from the days of wooden skis, when to get a stiffer ski you had to get a ski with more camber. With modern ski manufacturing technology, camber and stiffness are independent.

### The paper test

Have the student stand on both skis on a flat, clean surface. If the skis have adequate stiffness, you should be able to put a piece of paper under each ski and move it from a point at the back of the binding to a point about thirty centimetres in front of the binding. Then have the student put all of his or her weight on one ski, then the other. With all of the student's weight on one ski, the paper should be pinned to the floor and immovable. If each ski can't be flattened enough to pin the paper to the floor, then the skis are too stiff and the skier will not be able to get grip.

### Poles

As a general rule, poles for classic technique should be the skier's height in centimetres less 30 (which is about the same as snugly under the armpit). Skating poles should be the skier's height in centimetres less 20 (or just up to the chin). Poles should be put on by having the hand reach up through the strap, and should be tightened so that the poles naturally recover to the correct position when the hand is moved forward. Poles should be gripped lightly, with power generated through the strap.

## **Clothing**

You probably don't have a great deal of control over this, but there are a few things that are important. You should advise students to avoid wearing cotton. Cotton loses all of its insulating properties when it gets wet, and people do tend to get wet when they cross-country ski, either because they have been falling down or they have been sweating. Cotton socks are particularly bad. Wool socks are excellent, and wool/polypropylene blends are even better. Jeans are not recommended (that cotton thing again), but if you have people who insist on wearing them it is a good idea if they wear some kind of long underwear or tights underneath. Heavy parkas should be avoided if at all possible. Running and cycling gear is good, particularly things like wind pants and jackets. If at all possible, people should dress in a number of light layers so that they can shed clothing if they get too warm.

## **Teaching considerations**

Teaching children to cross-country ski in a school setting presents a number of challenges. Some of these challenges are:

- A very high student to instructor ratio. The Canadian Association of Nordic Ski Instructors recommends a ratio of six to eight students per instructor. Obviously, you won't have that in a typical school situation: your ratio will be more like 20 or 30 to one.

- It's cold outside. You don't have the luxury of allowing the students to stand around watching lots of demonstration. You have to keep them moving, without being able to provide lots of individual instruction, in an area that is not really conducive to ski instruction.

- It is unlikely that you will have groomed tracks, or a hill, or a ski playground.

- You may have the logistical problem of having to wax twenty or thirty pairs of skis.

The good news is that you can still provide a positive experience even with all these problems. Cross-country skiing is a very technical sport, but the techniques can be broken down into a very small number of skills that can be taught independently and then combined into the specific techniques. These skills are:

- 1) gliding on one ski;
- 2) pushing with both poles at the same time ('double poling'); and
- 3) alternating pole pushes (which I call 'single poling' for lack of a better term).

## **Teaching classic technique**

The most important skill in cross-country skiing is the ability to glide on one ski, and the best way to teach it is using a technique called 'scooters'. 'Scooters' is gliding on one ski without using poles, using your free foot to propel yourself forward. There are a

number of benefits to using scooters as an instructional technique: it teaches balance and posture; it doesn't require tracks or a teaching grid; it lends itself to all kinds of games, drills and relays; it lets you keep the group within a small area; and it minimizes the differences between your most able and least able students.

For your first session, have all the students put on just one ski (but they will need both boots, since they are going to be switching the ski back and forth between feet). Start by showing them good ski posture, which you can do inside where it's warm. Good ski posture is really bad posture: you want the students slouched forward, with a bend at the ankles. Think of the athletic ready position, and then have them round their backs. Or tell them to stand like a gorilla. However you choose to do it, good ski posture is absolutely essential, and you should emphasize it at the start of every lesson, and several times during each lesson as well. A critical component of good ski posture is bending at the ankles. I try to avoid telling students to bend their knees, because some students will bend at the knees and not at the ankles, with the result that their butts will stick out behind them. This is not ideal, since we want weight to be forward, not back.

Once your students have the correct posture and they are each wearing just one ski, play some games. For at least ten years now I have started every Jackrabbit session with a game of Shark Attack. This game is basically British Bulldogs, and is also known as Sharks and Minnows. Whatever you choose to call it, it works like this: mark out a reasonably large area (say 30 meters by 20 meters) using cones, toques, ski poles, or whatever. Pick someone to be 'it'. The 'it' stands in the middle; everyone else stands behind one side of the field. When the 'it' says 'go', or 'Swedish Bulldogs' or 'Shark attack' or whatever you like, everyone tries to get to the other side of the field without being tagged by the 'it'. Everyone who gets tagged stays in the middle, and helps the 'it' tag people on the next round. The last person caught is the 'it' for the next round. Before you start the next round, have people switch their ski to the other foot. If you have just had a recent snowfall and your ski area has deep snow, a few games of shark attack will flatten it down nicely.

The idea behind having people on one ski is to teach them how to balance and glide, without having them worry too much about slipping and falling. Play a few rounds of Shark Attack, and then switch to something else. Other good games are:

-Two-headed Dragon: this game can be played in the same area you used for Shark Attack. Have two or three 'its'. When an 'it' tags someone, they link arms (or hold hands). As more people are tagged, they join the dragons, which continue to get larger. The longest dragon wins (or the last person caught wins).

-Blobs: a variation of Two-headed Dragon. Once the chain grows to four people, it splits into two. You end up with chains of two and three people chasing individuals around.

-Tag: this game doesn't need much explanation. Have two or more 'its' who should carry something bright so that they can be identified. I have them hold bright orange cones, but you can use toques, flags, whatever you have. There are some interesting variations: in Elbow Tag students can't be tagged when they have linked arms

(while facing in opposite directions), however, if someone else links up then the person on the other side has to unlink and may be tagged.

All of these games may be played on one or two skis (without poles). Another good game that can be played on one or two skis is soccer: have the players hit the ball with their hands rather than their feet. This promotes good ski posture. Use more than one ball to keep more people occupied. Other good games are handball and field hockey. One important safety issue: do not let people dive and roll to avoid being caught when you play tagging games. The dive and roll results in ski tips zipping through the air at eye level, which is potentially very dangerous.

After a few games I usually switch to some relays. Break your group into teams of three to six students, and try some of the following relays:

- the speed relay: the first member of each team goes as fast as he or she can to the other side of the playing field (twenty meters is a reasonable distance for starters). She turns around and races back, tagging the next member of the team, who does the same thing. The colder the conditions, the smaller the teams should be.

- the add-on relay: instead of tagging off, the next person on the team links up the first one. The two members of the team go to the end of the course and return, where they link up with the next member of the team. Keep the teams from getting too big, otherwise the first person on the team gets *way* too tired.

- the counting relay: instead of trying to be fast, each member of the team tries to take as few pushes as possible to glide to the other side of the play area. The team with the fewest pushes wins. Team members can go all at once or one at a time.

- three-legged race: two students link arms to race. This works best if they have their single skis on opposite feet, but it isn't necessary.

Obviously, you can also do most of these things as individual drills rather than relays. You can also play tag, shark attack, etc. while students are linked in twos or threes.

In order to keep people warm, you want to keep them moving as much as possible. I like to start with games to get everyone moving. When they get tired from the games, you can switch to relays, so people get a chance to rest. If conditions are cold, switch back to games when people start to look chilly (or bored). Most of the skills can be taught with games and relays, so you don't have to do a lot of one-on-one. This is good since you won't have time for it anyway.

Once people start to get comfortable with the one ski stuff, you can have them do almost all of the same things on two skis. However, to break things up you might first want to teach them to double pole. Double poling is a technique in its own right, and is also used in most of the skating techniques and two of the three classic techniques. You can teach double poling by demonstrating it, then having people practice individually. You can also have people use it in relays: going as fast as possible, or trying to glide as far as possible, or taking the fewest pushes to get to the other side. Poles and games don't work too well together, so I would stick with relays and drills when you work on poling.

When you teach double poling, remember that this is primarily abdominal work, not arm work. Try to get your students to crunch down to ninety degrees, then follow through with their arms while keeping their legs straight. You can get them to try this initially as a simulation in the gym or outside without poles: have the students practice extending their arms and contracting their abs while keeping their legs straight. Then have them do it with skis and poles.

You won't have to wax skis at all if you work on one-ski skills and double poling in the same session. When you start to work with two skis, you can play all the same games as you did with one ski (and no poles), but you will have to wax unless you have waxless skis.

The next step in teaching diagonal stride is to teach the students how to alternate their pole pushes (that 'single poling' thing again) and to use their poles for propulsion and not balance. Have your student propel herself by pushing on the right pole, then the left (just like in diagonal stride) while keeping her legs together. You can do this in relays as well, but it is very tiring so most people can't do it for very long. You can go from this right into diagonal stride.

A good progression for teaching classic technique is: games and relays with one ski; games and relays with two skis; a single poling relay, and then have them try skis and poles together. You can stick in double poling anywhere.

There are a number of things you can try next. Have your students try to ski with one pole and one ski on the opposite arm and leg: this works like half of a diagonal stride cycle. They can use this in relays, or you can have them do it as a drill. Another interesting drill is having them try skiing with two skis and one pole. This often helps students who are having trouble coordinating their arms and legs. You can have some fun with this as well if you let them try to propel themselves any way they want with one pole. I have named one of the most popular techniques 'the gondolier': you can probably imagine why.

The last classic technique is called one-step double pole, or kick double pole. It is a combination of diagonal stride and double poling. It consists of striding forward while swinging both arms forward, and then completing a double poling motion while the push leg recovers beside the gliding leg. The timing is a little tricky, but you can usually teach it by having the students try while using two poles and just one ski.

## **Turning**

Skiers need to know how to turn. Most students will pick up how to change direction from the one-ski and two-ski games and drills, but there are better ways to turn. The two types of turns on cross-country skis are called skate turns and step turns. They both involve pushing off the inside edge of one ski while angling out the other ski and

stepping on to it, then recovering the initial pushing ski to a position parallel to the other ski. Then the process is repeated. The movement is the same for step turns and skate turns, but skate turns also involve a double poling action while step turns are done without poling. Step turns are also a useful downhill technique.

Step turns and skate turns can be taught by setting up squares with cones, and having the students practice the turn around the cones. Once they are comfortable turning to one side, have them go around the cones in the opposite direction. Then get them to practice weaving through a line of cones. These drills can also be done as relays.

## **Skating**

Step turns lead naturally into skating. I have found the following progression works very well. Some of these things defy brief description, so watch for the demonstrations.

Step turns

Marathon skate without poles (skating while pushing to only one side)

Three-legged skate (no pole marathon skating with a partner)

Mikeskate (one skier pushes another)

Free skate (skating without poles)

Chariot races (one skier tows another)

An important note when teaching skating: the push is to the side, not to the back. The push has to be to the side in order to keep the push ski moving. Note that “pushing to the side” really isn’t pushing to the side, in fact, you are pushing perpendicular to the line of travel down the trail, not perpendicular to the direction in which the glide ski is facing. Three-legged skate reinforces this.

## **Technique checklists**

### *Diagonal stride*

Posture

Ankle flex

Butt forward

Recovery foot landing beside or in front of other foot

Strong forward push

Arms comfortably extended, hands low

Arm moves past leg during poling phase

Trailing leg and body form a straight line during push

### *Double poling*

Body and legs should form a straight line at the start

Ankle flex

Arms comfortably extended  
Butt moves forward while arms extend  
Abdominal crunch to 90 degrees while legs stay relatively straight  
Hands move past legs

### One-step double pole

One leg goes forward and one leg goes back while arms go forward  
Crunch as in double poling

## **Common errors and how to fix them:**

### Diagonal stride

There are a number of common mistakes that can be diagnosed and remedied without too much difficulty. The errors and their remedies are as follow:

- the skier is reaching too high with her hands too high: tell her to keep her hands low
- the skier's skis make a slapping sound. This occurs because the recovery foot is landing behind the kicking foot. This causes a very noticeable slapping noise. The cause is usually too upright posture: the recovery foot will usually land at the centre of gravity. If the skier is too upright, the centre of gravity moves backward. It can also be caused by the skier not striding forward with enough oomph.
- sitting back. This usually occurs if the skier does not flex enough at the ankle.
- poling hand not following through. Often occurs because the skier is gripping the poles too tightly.

### Double poling

- the skier sits back rather than moving his body forward. Tell the skier too imagine that someone is poking them in the small of the back.